ATM-X

Air Traffic Management – eXploration
Urban Air Mobility Overview

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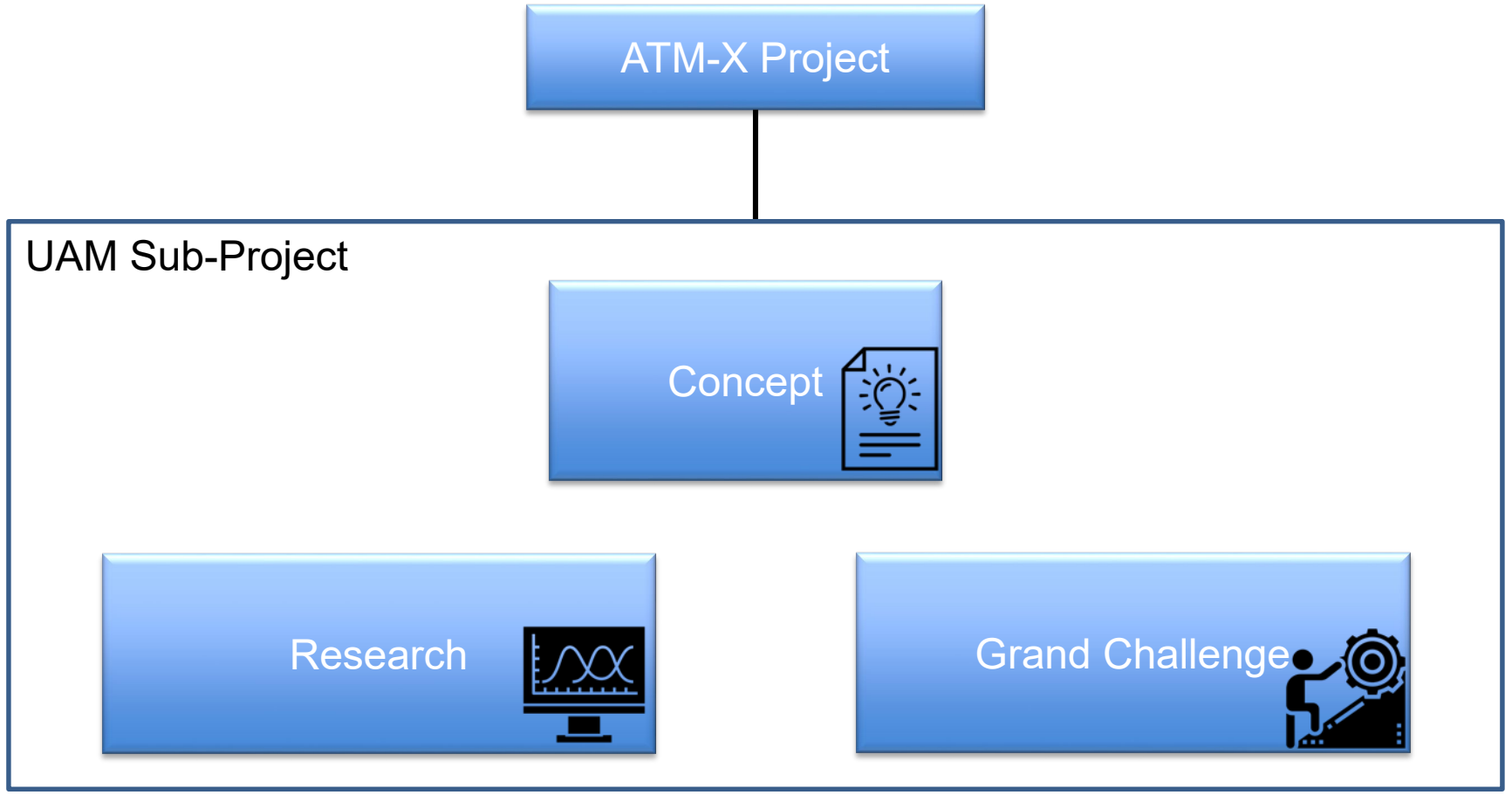
Urban Air Mobility Operations

Motivation: Burgeoning UAM market estimated to be in the billions of dollars and will need a system to manage high-tempo airspace access and high-density operations

Approach: Develop UAM airspace concept, build and test a UAM airspace system (extended from UTM) and UAM services to define requirements to enable mature UAM operations

UAM Sub-Project Overview



UAM Concept and Research

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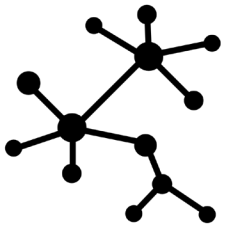
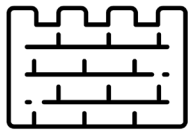
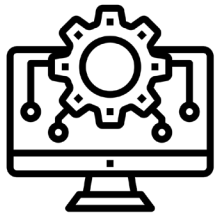


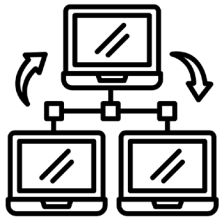
Developing concept of operations for UAM in collaboration with other NASA projects, the FAA, and the UAM community



Identifying and characterizing technical challenges for UAM airspace operations that the UAM community must tackle

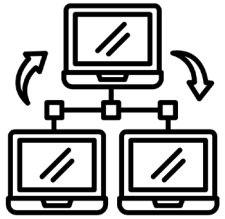


Developing and utilizing airspace algorithms for research; leveraging, adapting, extending existing algorithms whenever possible

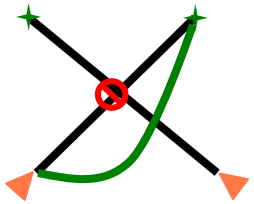


Defining information exchange requirements for interoperability across UAM airspace technologies (current research focus)

UAM Research Questions



What are the information exchange requirements and protocols needed for third-party airspace management services to interoperate?



What are the UAM separation requirements?

What are effective management strategies for UAM operations under uncertainties?

What are effective management strategies and procedures for minimizing noise generated by UAM operations?

ATM-X in UAM Grand Challenge

UAM Grand Challenge

- Challenge the industry to execute ecosystem-wide safety and integration scenarios
- Raise the water level for all
- Build knowledge base for requirements and standards
- No purse or prize money

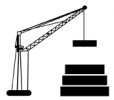
GC-Developmental Test (2020) and GC-1 (2022) flight activities
with simulation activities to prepare before each

ATM-X in Grand Challenge

- Developing and hardening the core UAM airspace system for GC simulation and flight activities

  - Supports data sharing and integration to ‘plug and play’ technologies through interfaces

  - Enables NASA and GC partners to collaborate

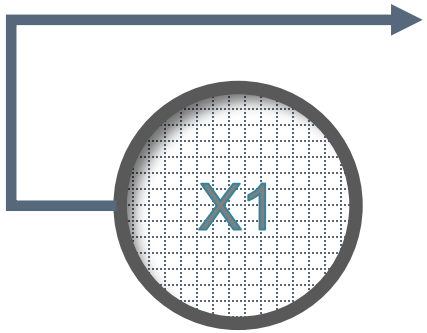


  - Builds upon UTM software and adds access to data and services needed for GC

- Conducting simulations of GC scenarios with GC airspace partners in preparation for GC flight tests

ATM-X UAM in GC

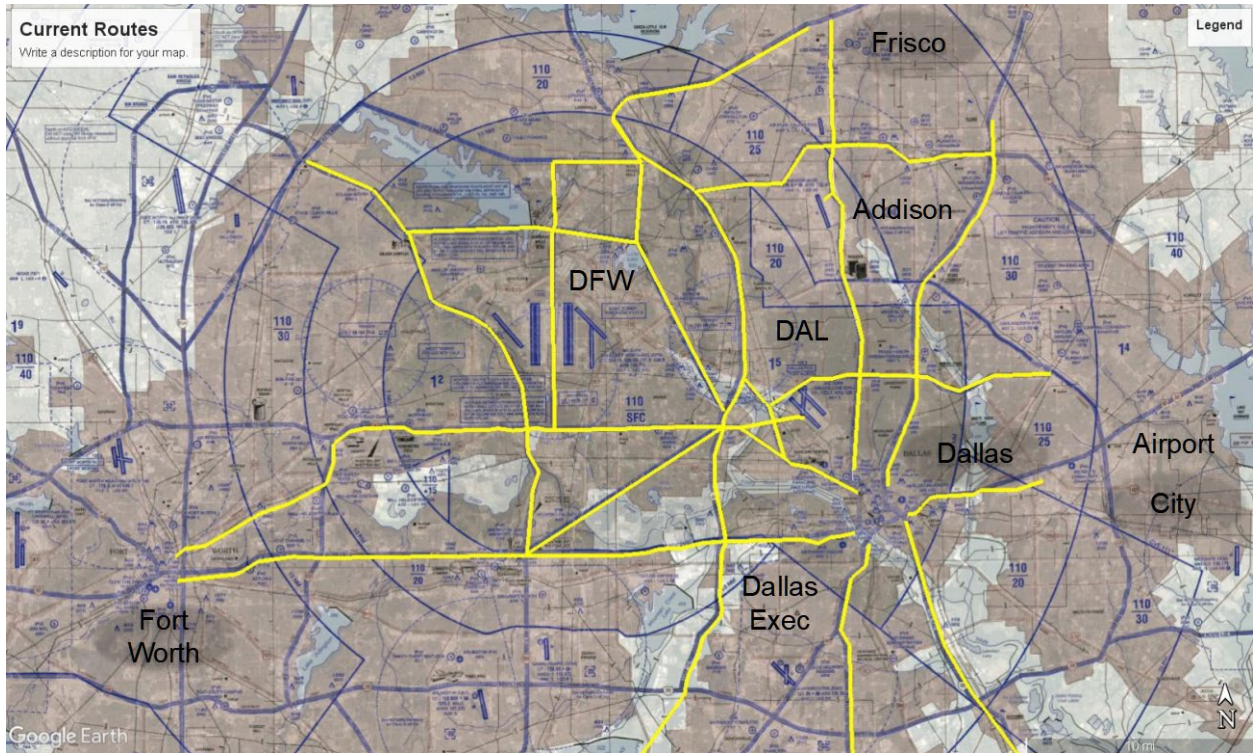
X1: Internal Connections (2018)



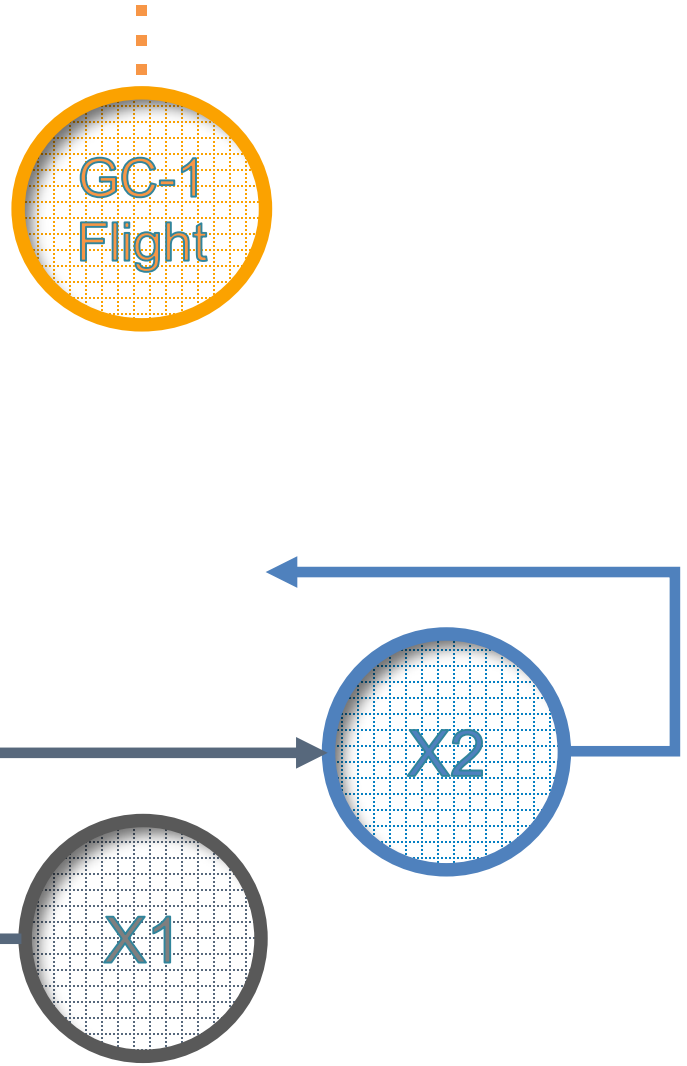
X1

Goal: Build up capabilities to evaluate UAM concept and technologies and to better understand UAM operations

Approach: Assess scalability of simulation capability by evaluating low to high tempo UAM flights managed with near-term procedures in DFW area



ATM-X UAM in GC



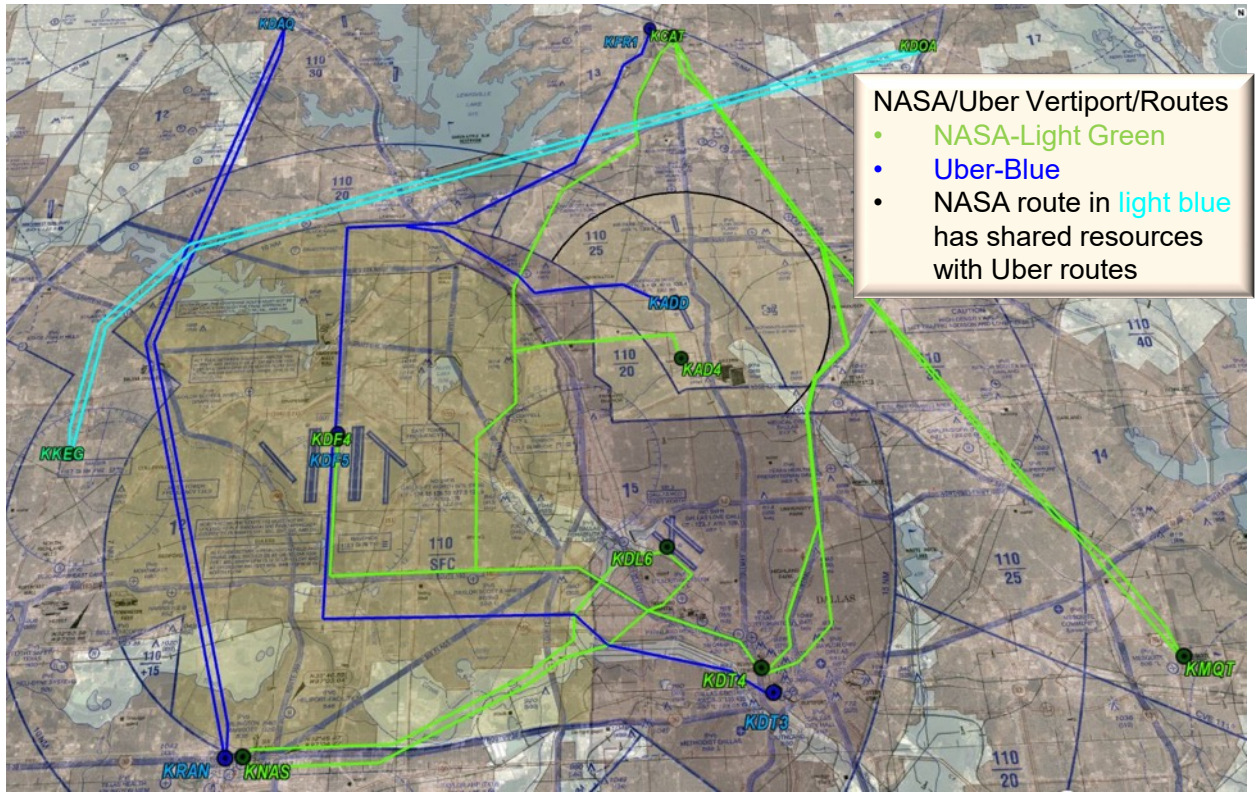
X2: Build for GC-DT, Industry Collaboration (2019)

X1: Internal Connections (2018)

X2

Goal: Determine if the UAM airspace system can enable the high-tempo information exchange required between simultaneous high-tempo UAM operations by multiple operators in shared airspace

Approach: Conduct lab evaluation with industry partner Uber using the UAM airspace system



X2 Accomplishments

Expanded performance limits of UTM implementation in collaboration with NASA UTM team to meet UAM simulation requirements

- Modifications made to enable simulation of mature UAM operations (up from about 40 concurrent operations with the UTM implementation as is)
- Incorporated design insights gained during UTM activities

Conducted simulations that showed UTM architecture is scalable for mature UAM operations

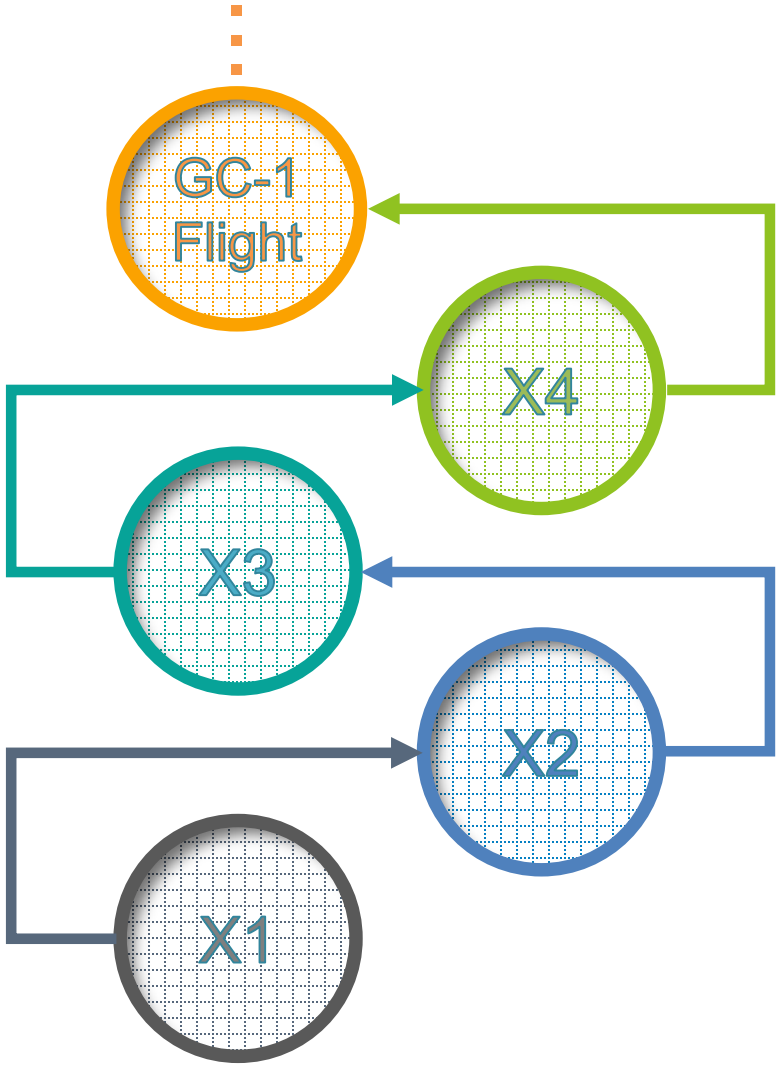
- 100+ UAM operations simulated concurrently by NASA and Uber

Identified additional system performance enhancements for mature UAM operations

- Different information exchange protocol needed for high-tempo data in mature UAM operations (e.g., 1 Hz position updates); alternative protocols being explored
- Need to transition to latest implementations of system components provided by industry for additional performance improvements; currently underway

X2 Demonstrated that the UTM Architecture is Scalable for mature UAM operations

ATM-X UAM in GC



X4: GC-1 Final Simulations (2021)

X3: GC-1 Initial Simulations (2020)

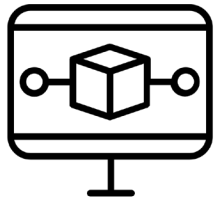
X2: Build for GC-DT, Industry Collaboration (2019)

X1: Internal Connections (2018)

X3 and X4

X3

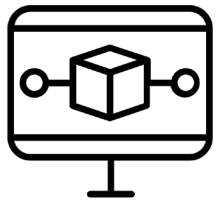
Develop sandbox for GC airspace partners to connect their technologies



Conduct simulations on a subset of GC-1 scenarios with GC airspace partners

X4

Modify information exchange interfaces for testing in GC, in collaboration with the FAA and GC airspace partners



Conduct simulations on the full set of GC-1 scenarios with GC airspace partners to prepare for GC-1 flight tests

Concluding Remarks

ATM-X UAM is focused on the airspace aspects of UAM

- Developing UAM concept of operations in collaboration with other NASA projects, the FAA, and the UAM community
- Conducting research towards defining airspace requirements for mature UAM operations and to identify and characterize technical challenges
- Developing and hardening the core UAM airspace system for simulation and flight activities in Grand Challenge and conducting GC simulations with GC partners

Aloha!

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